

## PATENT ABSTRACTS OF JAPAN

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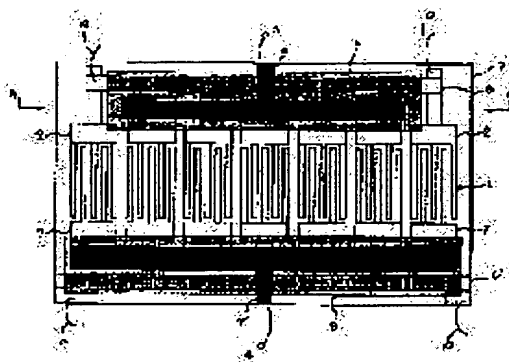
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## (54) MULTIELECTRODE TYPE SURFACE ACOUSTIC WAVE DEVICE

## (57)Abstract:

PURPOSE: To reduce the number of wire-bonded parts, to easily perform manufacturing, and to easily take matching with an external circuit by connecting the earth pads of a converter with a common bus bar, and interposing insulating film between an active side pad and an electrode.

CONSTITUTION: Plural reed screen type converters 1 are arranged so as to use a transmission line for them in common on a piezoelectric substrate 5, and each converter is provided with an earth side pad 2 and the active side pad 7 at its terminal part. Each pad 2 is connected with the common bus bars 6, 6' on an input terminal part 3 side and an output terminal part 4 side, respectively. Meanwhile, the pads 7 are not connected with each other on the same flat plane, however, the insulating film 8 is laminated on the upper planes of them. The film 8 is formed so that all the pads 7 located on both sides can be covered. The electrode 9 is formed on the film 8 so as to cover the pad 7 continuously, respectively on the input terminal part 3 and the output terminal part 4. The earth terminal 10 is wire-bonded from each terminal part of the bus bars 6, 6' on the input side and the output side to the outside.



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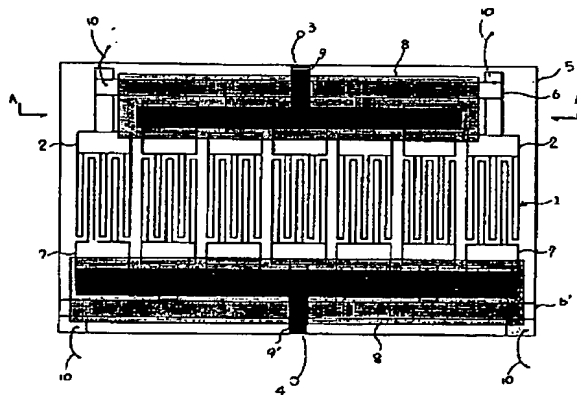
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(54) 【発明の名称】 多電極型弾性表面波装置

(57) 【要約】

【目的】 ワイヤボンディング箇所が少なく、製造が容易であり且つ外部回路との整合が容易である新規な多電極型弾性表面波装置を提供する。

【構成】 すだれ状変換器 1 を同一弾性表面波伝搬路上に複数個有する多電極型弾性表面波装置であり、アース側パッド 2 が入力側と出力側においてそれぞれ共通バスバー 6 で結ばれ、入出力電極 9, 9' がアクティブ側パッド上 7 に絶縁膜 8 を介して形成されている。



## 【特許請求の範囲】

【請求項1】 すだれ状変換器を同一の弾性表面波伝搬路上に複数個有する多電極型弾性表面波装置において、該変換器のアース側パッドが該装置の入力側と出力側においてそれぞれ共通バスバーで結ばれ、入出力電極がアクティブ側パッド上に絶縁膜を介して形成されていることを特徴とする上記多電極型弾性表面波装置。

【請求項2】 請求項1の装置の出力端子及び入力端子にそれぞれインダクタンス素子を並列に接続したことを特徴とする多電極型弾性表面波装置。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明は、ワイヤボンディング箇所が少なく、製造が容易であり且つ外部回路との整合が容易である弾性表面波装置に関する。

## 【0002】

【従来の技術及び発明が解決しようとする課題】近年、圧電体上にすだれ状変換器を形成した弾性表面波デバイスが知られており、このデバイスを用いてフィルタ、遅延線、レゾネータ、光機能素子等を構成することができる。特に、弾性表面波フィルタは小型化できるため、携帯電話等の移動通信用のフィルタとして注目されている。この用途には、これまで多数個のすだれ状変換器を弾性表面波の共通の同一伝搬路上に配置したいわゆる多電極型弾性表面波フィルタが検討されている。

【0003】従来の多電極型弾性表面波フィルタの構造を図4に示す。このフィルタは、複数の変換器1が同一弾性表面波伝搬路上に配列されており、これらの変換器のアース側パッド2はそれぞれ外部とワイヤボンディングで結線する必要があった。このため、ボンディング作業が非常に煩雑となっていた。このようなワイヤボンディングの回数が多いことはそれだけ工程の歩留低下、信頼性低下の要因にもなっていた。例えば、同図の電極構成ではアース部の7ヶ所と入出力部3、4の2ヶ所、合わせて9ヶ所のワイヤボンディングが必要であった。

【0004】そこで本発明の目的は、ワイヤボンディング箇所が少なく、製造が容易であり且つ外部回路との整合が容易である新規な多電極型弾性表面波装置を提供することにある。

## 【0005】

【課題を解決するための手段】本発明者は上記課題を解決するために鋭意、検討研究した結果、従来ワイヤボンディングされていた各変換器のアースパッドを共通のバスバーで結び、アクティブ側パッドと電極間に絶縁膜を介在させることにより、製造が容易で且つ容量を直列に内蔵した多電極型弾性表面波装置を開発することに成功した。

【0006】すなわち本発明は、すだれ状変換器を同一の弾性表面波伝搬路上に複数個有する多電極型弾性表面波装置において、該変換器のアース側パッドが該装置の

入力側と出力側においてそれぞれ共通バスバーで結ばれ、入出力電極がアクティブ側パッド上に絶縁膜を介して形成されていることを特徴とする上記多電極型弾性表面波装置である。

【0007】本発明の多電極型弾性表面波装置の構造の一具体例を図1に示す。複数のすだれ状変換器1が圧電基板5上にそれらの伝送路を共通にするように配列されており、各変換器は端部にアース側パッド2とアクティブ側パッド7を有している。各アース側パッド2は、入力端部3側及び出力端部4側において、それぞれ共通のバスバー6、6'で結ばれている。一方、各アクティブ側のパッド7は、同一平面内において互いに結ばれていないが、それらの上面に絶縁膜8が堆積されている。図2に図1の装置をA-Aに沿って切断した断面図を示す。絶縁膜8は、同図に示すように両側に位置するアクティブ側のパッドをすべて覆うように形成する。図1の入力端3及び出力端4において、それぞれ、各アクティブ側のパッド7上を連続的に覆うように絶縁膜上に電極9が形成されている。入力側及び出力側のバスバー6、6'の各端部からはアース端子10が外部にワイヤボンディングされている。

【0008】図1及び2に示すような構造の多電極型弾性表面波装置の製造方法を以下に示す。最初に、例えば、フォトリソグラフィを用いて、圧電基板上に共通の伝送路を形成するように複数のすだれ状電極のパターンとこれら電極のアース側端子を結ぶバスバーとを形成する。次に、例えば、スパッタリング法を用いて、アクティブ電極側パッドとアース共通バスバーとを覆うように例えば、 $\text{SiO}_2$ の絶縁膜を入力側及び出力側にそれぞれ形成する。そして、図1に示したようにアクティブ側パッドを覆うように絶縁膜上に電極を形成する。電極の形成方法として、例えば、真空蒸着法が便利である。こうして電極を絶縁膜を介して形成することにより、パッドと上部電極との間に容量結合が創設されることになる。

【0009】図1及び2に示した構造において、圧電体基板材料として、例えば、タンタル酸リチウム、ニオブ酸リチウム、水晶等が挙げることができる。また、電極材料としては、例えば、アルミニウム及びアルミニウム合金等を挙げることができる。絶縁膜としては例えば $\text{SiO}_2$ が好適である。これらの材料は、特にそれらに限定されず、本発明の多電極型弾性表面波装置を構成できるものならば種々の材料を用いることができる。

【0010】本発明は上記のような構造を採用したことにより以下のような作用及び利点を有する。

(1) 弾性表面波装置のワイヤボンディング数を減らせる。従って、すだれ状変換路の数が多い程ボンディング数を減らすことができ、多電極弾性表面波装置の製造工程が簡略化できる。

(2) 本発明の多電極型弾性表面波装置の構造はウエー

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ハ状態で形成できるので大量生産に適する。

(3) 電極とアクティブ側パッド間に絶縁膜を介在しているので、図3に示すように容量11が弾性表面波素子12の外部に直列に形成されたのと同様の回路13を構成することになる。従って、この容量を整合回路の一素子として利用することにより外部回路の部品点数を減らすことができる。例えば、本発明の多電極型弾性表面波装置に並列にインダクタンス素子を付加するだけでL字型整合回路が構成でき、整合回路をパッケージ内に内蔵させることも可能になる。

【0011】

【発明の効果】本発明の装置はワイヤボンダ箇所が低減されているため、製造が容易であり、歩留、信頼性も一層向上することになる。また、製造コストの低下も達成される。また、本発明の装置は直列容量の機能をも内蔵しているので、整合回路の構成が簡単であり、部品点数の削減を図ることもできる。

【図面の簡単な説明】

【図1】本発明の多電極型弾性表面波装置の構造の一具体例を示す。

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【図2】図1の本発明の多電極型弾性表面波装置の断面構造を示す。

【図3】本発明の多電極型弾性表面波装置により構成された等価回路図である。

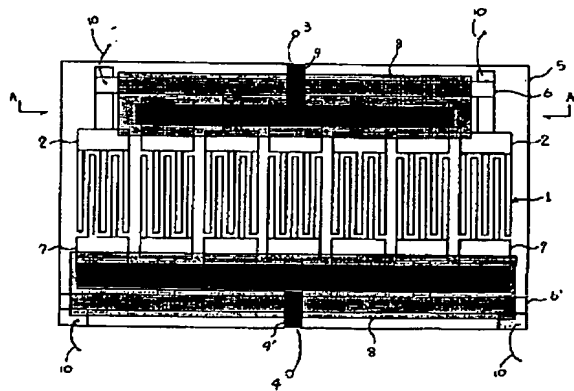
【図4】従来の多電極型弾性表面波装置の構造を示す。

【符号の説明】

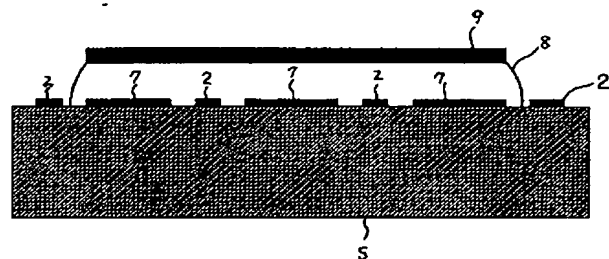
- 1 すだれ状変換器
- 2 アース側パッド
- 3 入力側端子
- 4 出力側端子
- 5 圧電基板
- 6 バスバー
- 7 アクティブ側パッド
- 8 絶縁膜
- 9 入出力電極
- 9' 出力側電極
- 10 アースワイヤボンダ
- 11 内蔵容量
- 12 弾性表面波素子

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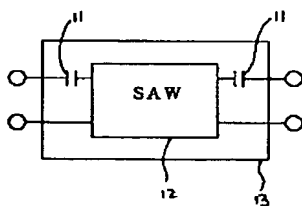
【図1】



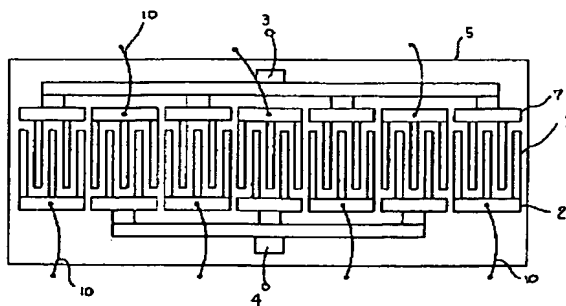
【図2】



【図3】



【図4】



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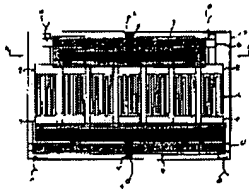
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(54) MULTIELECTRODE TYPE SURFACE ACOUSTIC WAVE DEVICE



(57)Abstract:

**PURPOSE:** To reduce the number of wire-bonded parts, to easily perform manufacturing, and to easily take matching with an external circuit by connecting the earth pads of a converter with a common bus bar, and interposing insulating film between an active side pad and an electrode.

**CONSTITUTION:** Plural reed screen type converters 1 are arranged so as to use a transmission line for them in common on a piezoelectric substrate 5, and each converter is provided with an earth side pad 2 and the active side pad 7 at its

terminal part. Each pad 2 is connected with the common bus bars 6, 6' on an input terminal part 3 side and an output terminal part 4 side, respectively. Meanwhile, the pads 7 are not connected with each other on the same flat plane, however, the insulating film 8 is laminated on the upper planes of them. The film 8 is formed so that all the pads 7 located on both sides can be covered. The electrode 9 is formed on the film 8 so as to cover the pad 7 continuously, respectively on the input terminal part 3 and the output terminal part 4. The earth terminal 10 is wire-bonded from each terminal part of the bus bars 6, 6' on the input side and the output side to the outside.

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**CLAIMS**

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[Claim(s)]

[Claim 1] The above-mentioned multi-electrode mold surface acoustic wave equipment characterized by tying the ground side pad of this converter with a common bus bar in the input side and output side of this equipment, respectively, and forming the I/O electrode through an insulator layer in the multi-electrode mold surface acoustic wave equipment which has two or more blind-like converters on the same surface acoustic wave propagation path on an active side pad.

[Claim 2] Multi-electrode mold surface acoustic wave equipment characterized by connecting an inductance component to juxtaposition at the output terminal and input terminal of equipment of claim 1, respectively.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention has few wirebonding parts and it is related with surface acoustic wave equipment with adjustment easy easily [ manufacture ] with an external circuit.

[0002]

[Description of the Prior Art] In recent years, the surface acoustic wave device in which the blind-like transducer was formed on the piezo electric crystal is known, and a filter, the delay line, a resonator, an optoelectronic device, etc. can be constituted using this device. Since it can miniaturize, especially the surface acoustic wave filter attracts attention as a filter for mobile communication, such as a cellular phone. The so-called multi-electrode mold surface acoustic wave filter which has arranged the blind-like converter of former many on the same common propagation path of a surface acoustic wave is examined by this application.

[0003] The structure of the conventional multi-electrode mold surface acoustic wave filter is shown in drawing 4 . This filter is arranged on the same surface acoustic wave propagation path, and two or more converters 1 needed to connect the ground side pad 2 of these converters with the exterior and the wire bond 10, respectively. For this reason, the bonding activity was very complicated. That there are many counts of such wire bond caused a yield fall of a process, and a dependability fall so much. For example, seven places of the ground section, two places of the I/O sections 3 and 4, and nine wirebonding in all were required of the electrode configuration of this drawing.

[0004] Then, the purpose of this invention has few wirebonding parts, and they

are to offer new multi-electrode mold surface acoustic wave equipment with adjustment easy easily [ manufacture ] with an external circuit.

[0005]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, wholeheartedly, by making the ground pad of each transducer by which wirebonding was carried out conventionally an insulator layer placed between an epilogue, an active side pad, and inter-electrode by the common bus par, as a result of doing examination research, this invention person was easy to manufacture, and succeeded in developing the multi-electrode mold surface acoustic wave equipment which contained capacity in the serial.

[0006] That is, this invention is the above-mentioned multi-electrode mold surface acoustic wave equipment characterized by tying the ground side pad of this converter with a common bus bar in the input side and output side of this equipment, respectively, and forming the I/O electrode through an insulator layer on an active side pad in the multi-electrode mold surface acoustic wave equipment which has two or more blind-like converters on the same surface acoustic wave propagation path.

[0007] One example of the structure of the multi-electrode mold surface acoustic wave equipment of this invention is shown in drawing 1 . It is arranged so that two or more blind-like converters 1 may carry out those transmission lines in common on the piezo-electric substrate 5, and as for each converter, it has the ground side pad 2 and the AKUTEIIBU side pad 7 at the edge. Each ground side pad 2 is connected with the respectively common bus par 6 and 6' to the input edge 3 and outgoing end section 4 side. On the other hand, although each pad 7 by the side of active is not mutually tied in the same flat surface, the insulator layer 8 has deposited it on those top faces. The sectional view which cut the equipment of drawing 1 along with A-A to drawing 2 is shown. An insulator layer 8 is formed so that all the pads by the side of [ which is located in both sides as shown in this drawing ] active may be covered. In the input edge 3 and outgoing end 4 of drawing 1 , the electrode 9 is formed on the insulator layer, respectively

so that each pad 7 top by the side of active may be covered continuously. From each edge of the bus par 6 of an input side and an output side, and 6', wirebonding of the grounding terminal 10 is carried out outside.

[0008] The manufacture approach of the multi-electrode mold surface acoustic wave equipment of structure as shown in drawing 1 and 2 is shown below. First, photolithography is used and the bus par which ties the pattern of two or more blind-like electrodes and the earthed pole terminal of these electrodes so that a transmission line common on a piezo-electric substrate may be formed is formed. Next, for example, using the sputtering method, it is SiO<sub>2</sub> so that an active electrode side pad and a ground common bus bar may be covered. An insulator layer is formed in an input side and an output side, respectively. And an electrode is formed on an insulator layer so that an active side pad may be covered, as shown in drawing 1. As the formation approach of an electrode, a vacuum deposition method is convenient. In this way, by forming an electrode through an insulator layer, capacity coupling will be founded between a pad and an up electrode.

[0009] In the structure shown in drawing 1 and 2, lithium tantalate, lithium niobate, Xtal, etc. can mention as a piezo electric crystal substrate ingredient. Moreover, as an electrode material, aluminum, an aluminium alloy, etc. can be mentioned, for example. As an insulator layer, it is SiO<sub>2</sub>. It is suitable. Especially these ingredients are not limited to them, but various ingredients can be used for them if they can constitute the multi-electrode mold surface acoustic wave equipment of this invention.

[0010] This invention has the following operations and advantages by having adopted the above structures.

(1) The wire Bond number of surface acoustic wave equipment can be reduced. Therefore, the number of BONDIGU can be reduced, so that there are many blind-like conversion ways, and the production process of multi-electrode surface acoustic wave equipment can be simplified.

(2) Since the structure of the multi-electrode mold surface acoustic wave

equipment of this invention can be formed in the state of a wafer, it is suitable for mass production method.

(3) Since the insulator layer is intervened between an electrode and an active side pad, the circuit 13 same with capacity 11 having been formed in the exterior of a surface acoustic element 12 at the serial, as shown in drawing 3 will be constituted. Therefore, the components mark of an external circuit can be reduced by using this capacity as one element of a matching circuit. For example, a L character mold matching circuit can be constituted only from adding an inductance component to the multi-electrode mold surface acoustic wave equipment of this invention at juxtaposition, and it becomes possible to also make a matching circuit build in in a package.

[0011]

[Effect of the Invention] Since the wire bond part is reduced, the equipment of this invention will be easy to manufacture and it will improve [ a yield and its dependability ] further. Moreover, the fall of a manufacturing cost is also attained. Moreover, since the equipment of this invention also contains the function of a series capacitance, the configuration of a matching circuit is easy and reduction of components mark can also be aimed at.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] One example of the structure of the multi-electrode mold surface acoustic wave equipment of this invention is shown.

[Drawing 2] The cross-section structure of the multi-electrode mold surface acoustic wave equipment of this invention of drawing 1 is shown.

[Drawing 3] It is the representative circuit schematic constituted by the multi-electrode mold surface acoustic wave equipment of this invention.

[Drawing 4] The structure of conventional multi-electrode mold surface acoustic wave equipment is shown.

[Description of Notations]

1 Blind-like Converter

2 Ground Side Pad

3 Input Side Edge Child

4 Output Side Terminal

5 Piezo-electric Substrate

6 Bus Par

7 Active Side Pad

8 Insulator Layer

9 ON Appearance Lateral Electrode

9' output side electrode

10 Ground Wire Bond

11 Built-in Capacity

12 Surface Acoustic Element

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2. \*\*\*\* shows the word which can not be translated.

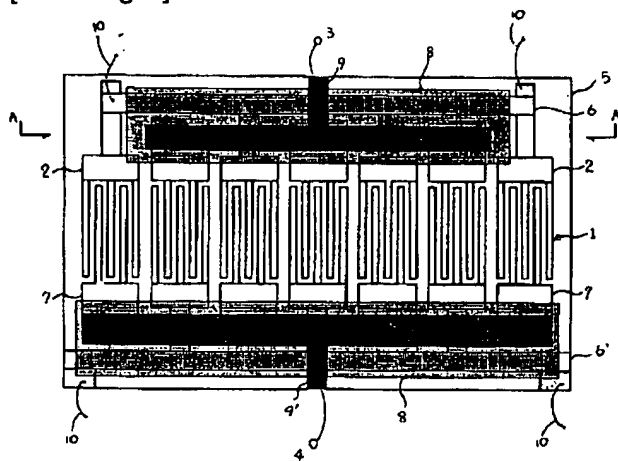
3. In the drawings, any words are not translated.

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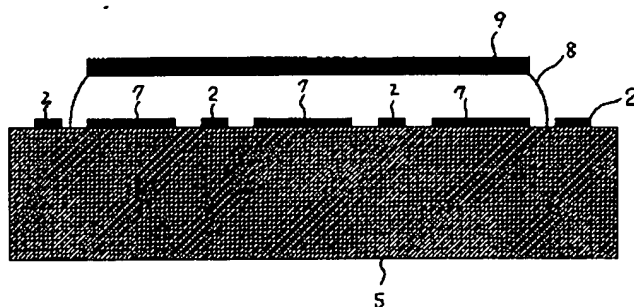
## DRAWINGS

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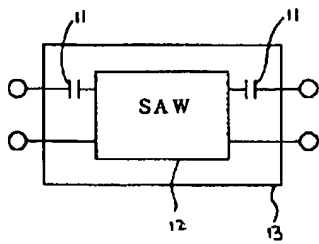
[Drawing 1]



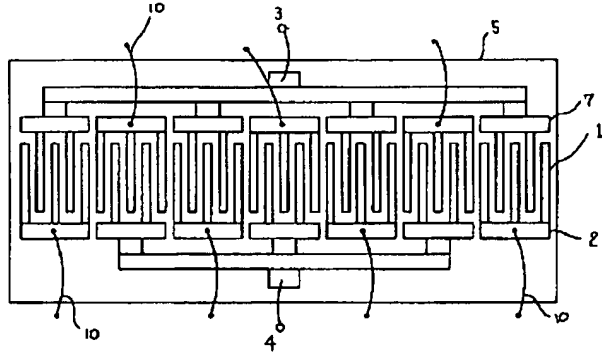
[Drawing 2]



[Drawing 3]



[Drawing 4]




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[Translation done.]

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